What is a Disease Cluster?

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Presentation Objectives

- The disease cluster investigation
- Focus on process and roles for public health officials
- Describe, by example, the parameters of a true cluster
- Issues inherent in the disease cluster model

Definitions

- A "cluster" is an unusual aggregation, real or perceived, of health events that are grouped together in time and space and that is reported to a public health department (CDC 1990)
- Infectious and non-infectious
- Cluster investigations sometimes lead to new disease etiologies or previously unknown diseases

Misleading Models of Disease Clusters

The Texas Sharpshooter - The use of statistical data (i.e. medical databases) to find clusters of disease without a plausible medical model.

Multiple Comparisons - Running numerous models until one provides the results you want.

Media/Activist driven model - people are sick and something must be the cause.

Typical Start to a Disease Cluster Investigation

- Environmental
  - Community interest
  - Single disease or group of diseases
  - Simultaneous public health and media interest
  - List of potential causes usually provided

Media/Community Driven Model

Subject: Point Loma fuel leak costs Navy millions/ Related to Cancer Cluster in Point Loma.

The Navy has spent $53 million to repair fuel tanks and clean up underground spills at Point Loma Naval Station, but a leak has spread at least to the boundary with the La Playa neighborhood.

Media/Community Driven Model

Since the initial meeting held at the SD Yacht club to start informing and investigating how so many could get such a rare form of cancer in such a small geographic area, we are sad to say that we have 6 more cases, bringing the total to over twenty. As a resident of Point Loma and a member of the Sidney Kimmel Cancer Center, we are pursuing more information from Capt Patton in the hopes that we can draw some attention and perhaps a larger investigation of unknown- to- us cancer victims with the help of the Navy.

Typical Start to a Disease Cluster Investigation

- Occupational
  - Unusual diseases or more than expected for the usual ones
  - Group of diseases
  - Management reluctant to acknowledge
  - Unions may leverage action
  - Media coverage depends on tension

Steps in Determining Type and Scope of Investigation

- Team approach regardless of type
  - Physician (not the epidemiologist)
  - Risk assessor or industrial hygienist
  - Risk communicator
  - Epidemiologist

Team Members - Physician

- Trusted voice - pick the right one; local doctor preferred
- Case ascertainment
- Exposure related to disease
- Medical record reviews
- Patient interviews
- Discussions with leadership

Team Members - Risk Assessor

- Establish exposure occurred through pathway analysis
  - Environmental record reviews
  - Obtain experts in hydrogeology, air dispersion modeling, etc.
  - Integrated Risk Information System (IRIS)
- Sampling strategy
- Estimate measures of exposure

Team Members - Industrial Hygienist

- Establish exposure occurred through occupation
  - Industrial hygiene survey record reviews
  - Obtain experts in ventilation, respirators, PPE, etc.
  - Material safety data sheet review
- Sampling strategy
- Estimate measures of exposure

Team Members - Risk Communicator

- Most valuable team member
  - Establish the level of scientific/medical communication with stakeholders
  - Presentation of materials
  - Meetings and forums
- Not confused with public affairs
  - possibly same person
  - Different missions

Team Members - Epidemiologist

- Relates disease process with exposure measures
- Model impact of behaviors on risk models
- Answers questions for the team
  - Especially what the data do not indicate
  - Realistic expectations of the findings of any study

Historical Disease Clusters

- Cholera in London, 1853

Historical Disease Clusters

Occupational

- Angiosarcoma in vinyl chloride workers
- Lung cancer in coke oven workers
- Mesothelioma in shipyard asbestos workers
- Asthma in beet-processing
- Hearing loss and work on flight decks

Examples of Cluster Investigations

- Vestibular dysfunction in OIF redeployers
- Childhood leukemia
  - Camp LeJeune
  - Fallon NV
  - Guam
- Cancer in laboratory workers
- Abnormal illnesses in office workers

Inherent Characteristics

- Cases related by time, location, or exposure
- Common exposure leads to disease
- Exposure must precede disease
- Time from first exposure must be sufficient to cause disease
- Behavioral risk factors must be part of the model
- Limited by the clinical diagnostic test

Typical Characteristics

- Small number of cases
- Exposure to numerous potential agents at low concentrations
- Retrospective estimation of exposure
  - Historical exposure reconstruction
- Suitable controls for case-control study
- Interactions of gene, behavior, and environment is infinite

Types of Cluster Studies

Cohort Analysis

- Looks at the total number of cases discovered in a population
- Requires estimation of person-time
  - Probably the hardest to estimate
  - Mobile population (people entering and leaving cohort during study period)
- Comparison to appropriate population

Cohort Analysis - Rates

- Prevalence - the number of cases over a defined period divided by the total population at risk; no time in cohort component
- Incidence - the number of cases over the study period divided by the total time each person in the cohort contributes to the study
- Usually expressed per 10K - 1 Million

Cohort Analysis - Comparisons

- Must have similar distribution of risk factors as the study population or be adjusted.
  - Lung cancer in military population is significantly lower than general population because it is very rare for a 24 year old to get lung cancer

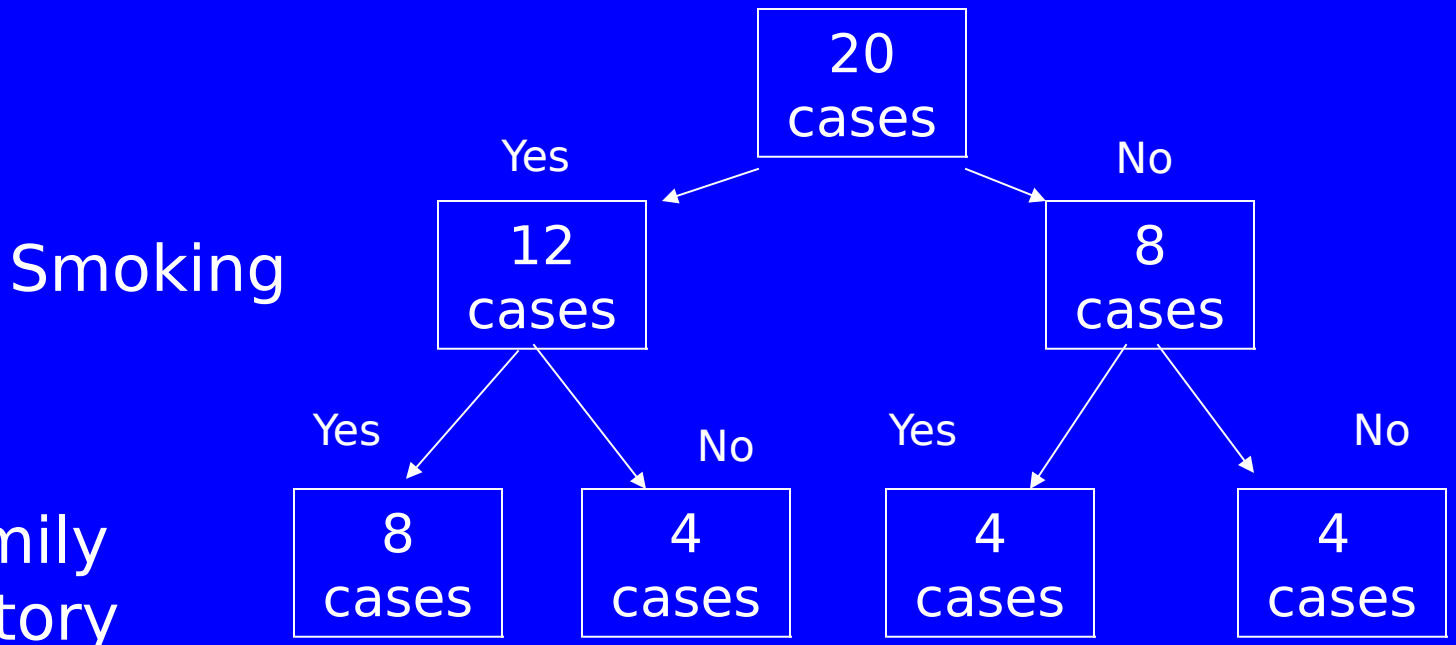
Case-Control Analysis

- Compare the impact of factors (exposure, genetics, and behaviors) on the risk of becoming a case
  - Cases - those with disease
  - Controls - those without the disease that had to have the same opportunity to become a case
  - Accounts for uncertainty in the estimate of risk

Case-Control Analysis

- Generally more expensive than a cohort study
- Usually based on hypotheses generated by cohort analysis
- Subject to confounding and/or effect modification
  - Confounding - risk factor is associated with the exposure
  - Effect modification - the impact of a risk factor is not the same across all groups
- For every risk factor in the analysis, at least 10 cases are needed.
  - Limited to unifactorial analysis

Number of Cases for a Study



Summary

- Disease clusters do exist, but usually lack a sufficient number of cases to conduct meaningful analysis
- Explore the potential causes as if the cluster does exist using a team approach
- Define the problem before someone defines it for you
- Call in the pros - NEHC, CDC, NIOSH